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Time-shared computer programs for officer structure policy planning.

Reifsnyder, Frank William.

Monterey, California ; Naval Postgraduate School

TIME-SHARED COMPUTER PROGRAMS FOR OFFICER STRUCTURE POLICY PLANNING

Frank William Reifsnyder, Jr.

United States
Naval Postgraduate School

THESIS

Time-Shared Computer Programs
for
Officer Structure Policy Planning

by

Frank William Reifsnyder, Jr.

Thesis Advisor: Kneale T. Marshall

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by

Frank William Reifsnyder, Jr.
Ensign, United States Navy
B.S., United States Naval Academy, 1970

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ABSTRACT

This thesis develops two personnel flow models which can aid the manpower policy planner to predict future officer structures through the use of a time-shared computer system. The underlying structure is presented for both models. One model considers promotions based on length of commissioned service. The other model considers promotions based on length of time in grade. Computer programs are developed for both models and sample outputs are shown. The programs are used on a time-shared computer system so that the policy planner can interact with the computer with a minimal knowledge of computer programming. The computer output is in a concise, easy to understand form.

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I. INTRODUCTION

This thesis develops two personnel flow models which can aid the manpower policy planner to predict future officer structures through the use of a time-shared computer system. (An important feature of this system is that the policy planner does not need to understand computer operation or computer language to use this capability.) Computer programs are written that model officer promotions two different ways. The programs are written so that the instructions and the computer responses are given in plain, easy-to-understand English. To use these programs, the user simply types in a few numbers in response to questions asked by the computer. The questions that the computer asks are designed to determine the various parameters that influence officer promotions and the officer structure in general. Approximately thirty-five questions are asked for each program. The actual number of questions varies according to the complexity of the model used.

In addition to the answers to the questions asked by the computer, the computer must also know the current state of the officer structure. This is entered into the computer at the same time the programs are loaded.

Both computer programs are written in FORTRAN. This enables their use on almost all digital computing systems. They are designed to be used in a time-shared mode. The computing time for either program is less than two seconds.

Promotion and retirement are the chief methods used by the Navy to control the size and structure of the officer inventory. The size of the inventory depends on many factors and parameters. These factors include the number of new ensigns commissioned each year, the number in each rank promoted each year, and the numbers that resign or retire each year. In addition, there are many limitations imposed by Title Ten of the United States Code and the Secretary of the Navy.

The first program developed is called the Time in Service Manpower Planning Model, and the theory for this program is developed in Section II. This model assumes that promotions are a function of the total length of commissioned service, and not the length of time in grade. In the case of a captain, this might by twenty years. Another assumption is that a fixed percentage (chosen by the policy planner) of officers are promoted to the next highest rank each year. These percentages may vary over the total span of commissioned service, but for any one year they are fixed. Losses to the system are assumed to depend on both rank and length of commissioned service.

The second program developed is called the Time in Grade Manpower Planning Model, and the theory for the program is developed in Section III. This model assumes that promotions are a function of the total time spent in each rank, and not his cumulative length of service. In the case of a captain, he might be promoted after five years as a commander. Losses are assumed to depend on rank and time spent in each rank, and again are chosen by the policy planner.

Section IV shows two sample runs of the programs with complete printouts of input and output. Each consists of only a few pages

of computer printout. This contrasts with the usual planning models which usually give voluminous output which is very difficult to interpret by the user.

II. TIME IN SERVICE MANPOWER PLANNING MODEL

A. INTRODUCTION

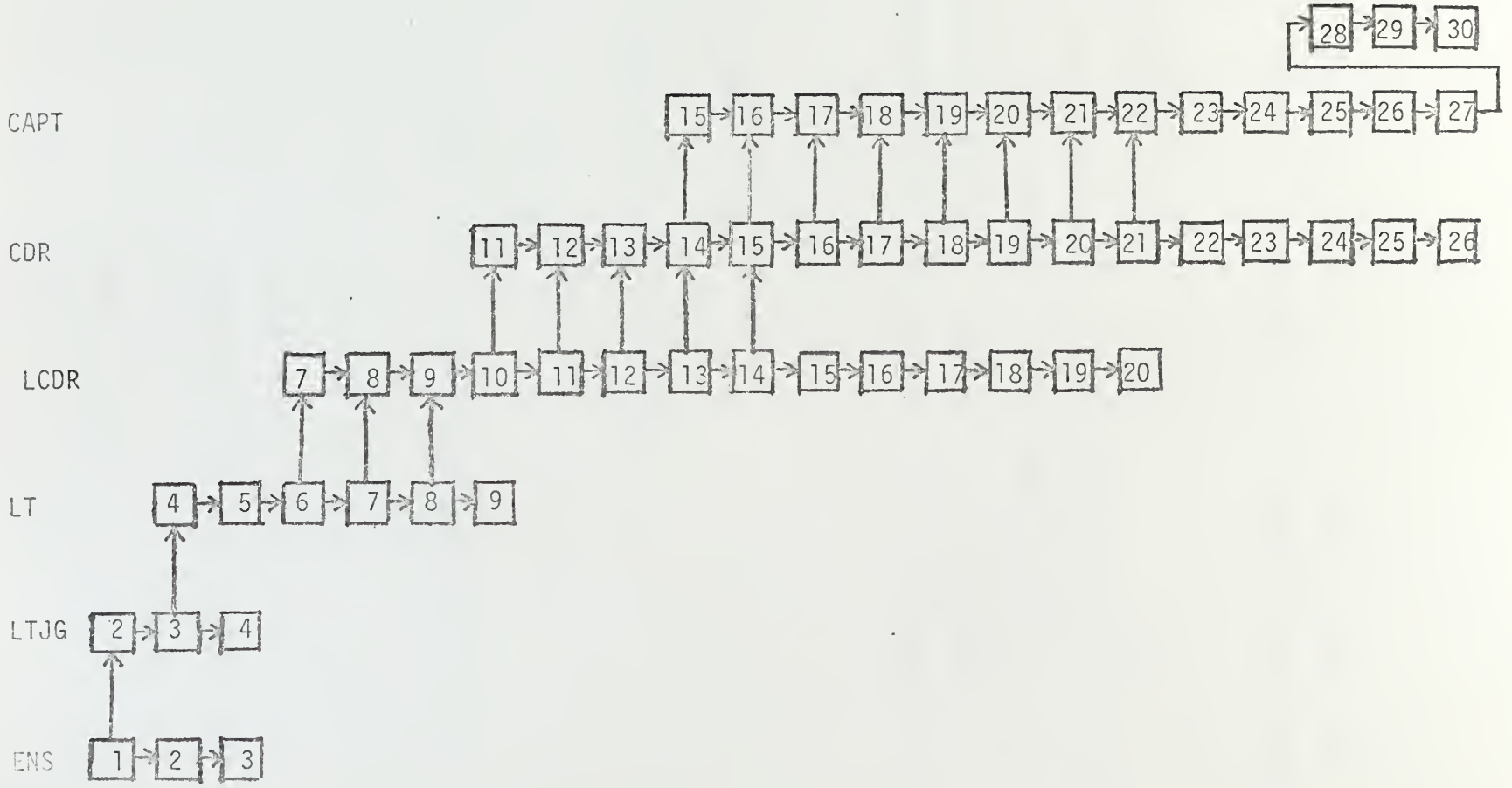
The Time in Service Manpower Planning Model (TIS) models the future flow of officer personnel in the Navy. In this model, promotions are assumed to be a function of the total amount of service after the date at which an individual is commissioned an officer. A typical flowchart is shown in Figure 1. The data used to construct this flowchart was taken from "The Officer Personnel Newsletter" which is published quarterly by the Bureau of Naval Personnel. In the October, 1970 edition, the following promotion flowpoints were given:

	Due Course	Maximum Acceleration
Flag eligible	24-25 years	18-19 years
Captain	20-21 years	14-15 years
Commander	14 years	10 years
Lieutenant Commander	8 years	6 years
Lieutenant	3 years	3 years

Normal officer promotions occurred at the times labeled "Due Course." Exceptional performers could be promoted at any time from the maximum acceleration points to the normal due course promotion points.

The TIS Manpower Planning Model examines the officer structure in discrete steps. The length of one step is one year. Each year, one of three events can happen. The officer can be promoted, he can remain in the same rank, or he can leave the system. The numbers of officers in each category are based on expected values, hence this model is deterministic rather than probabilistic.

Figure 1. Typical Time in Service Officer Promotion Flowchart.



The TIS Manpower Planning Model considers promotions before losses. That is, each year all promotions are accomplished before any losses are deducted from the system. Losses are a function of both rank and total commissioned service. The basic types of losses and the mathematical structure of the model are discussed in the following section.

B. MATHEMATICAL MODEL

Let R1(U,K) equal the number of ensigns present in year U who were commissioned in year K. Let P2(J) be the proportion of ensigns promoted J years after commissioning. Let L1(J) be the proportion of ensigns not promoted who leave the system J years after commissioning. Then:

$$
\begin{aligned}
R1(U,K) &= 0 && \text{if } U<K,\\
&= R1(K,K) && \text{if } U=K,\\
&= \prod_{I=K+1}^{U} [1-P2(I-K)][1-L1(I-K)]R1(K,K) && \\
& && \text{if } K<U\leq NT1+K,\\
&= 0 && \text{if } U>NT1+K,
\end{aligned}
$$

where R1(K,K) is the initial input of commissioned ensigns each year and NT1 is the maximum length of commissioned service for an ensign.

Similarly, let R2(U,K) equal the number of lieutenants (junior grade) present in year U who were commissioned as ensigns in year K. Let P3(J) be the proportion of lieutenants (junior grade) promoted to lieutenant J years after commissioning. Let L2(J) be the proportion of lieutenants (junior grade) not promoted who leave the system J years after commissioning. Then:

$$
\begin{aligned}
R2(U,K) &= 0 && \text{if } U \le K,\\
&= [1-L2(1)]\,[1-P3(1)]Q2(1) && \text{if } U = K+1,\\
&\quad \text{where } Q2(N) = R2(K+N-1,K)+P2(N)R1(K+N-1,K),\\
&= [1-L2(2)]\,[1-P3(2)]Q2(2) && \text{if } U = K+2,\\
&\quad \vdots\\
&= [1-L2(NT2)]\,[1-P3(NT2)]\,Q2(NT2) && \text{if } U = K+NT2,\\
&= 0 && \text{if } U > K+NT2.
\end{aligned}
$$

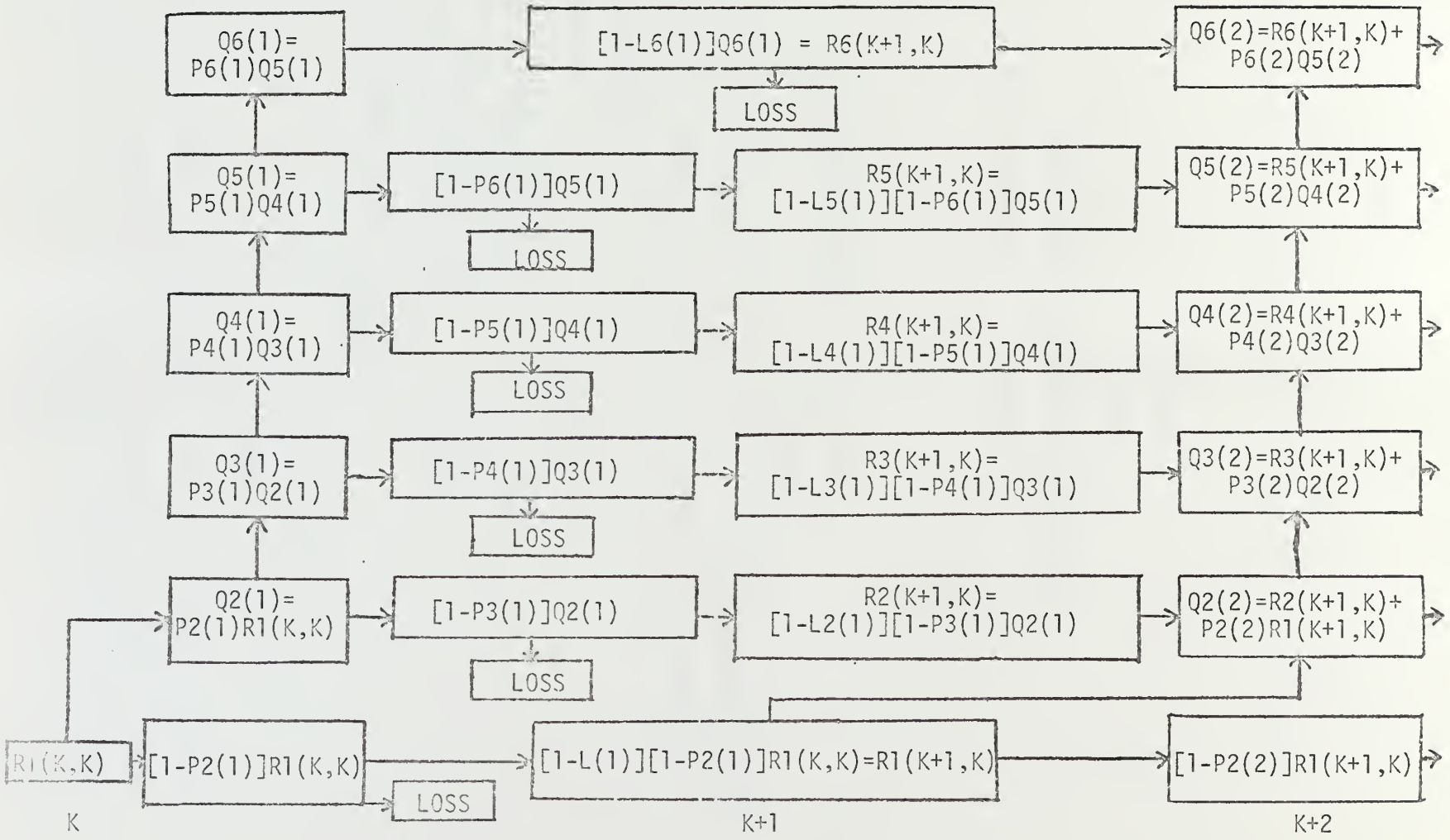
This is the most general case shown in Figure 2. It assumes promotions to lieutenant (junior grade) happen every year, beginning the year after commissioning. It also assumes that promotion to lieutenant can happen every year. This gives the policy planner great flexibility to determine the effects of new policies. Under the current policy, promotion to lieutenant (junior grade) occurs once, after the first year of commissioned service so that the above equation could be drastically simplified into the following expression:

$$
\begin{aligned}
R2(U,K) &= 0 \quad \text{if } U < T_2+K,\\
&= [P2(T_2)R1(K+T_2-1,K)] \prod_{I=T_2+K}^{U} [1-P3(I-K)]\,[1-L2(I-K)]\\
&\qquad \text{if } K+T_2 \le U \le NT2+K,\\
&= 0 \quad \text{if } U > NT2+K,
\end{aligned}
$$

where T_2 is the length of time for promotion from ensign to lieutenant (junior grade), and NT2 is the maximum length of commissioned service for a lieutenant (junior grade).

Equivalent equations are available for both general and special cases for the ranks of lieutenant, lieutenant commander, and commander.

Figure 2. Computing Structure of Time in Service Manpower Planning Model



This model treats the rank of captain as a special case. The time in service model only considers the rank structure from ensign to captain and thus promotion from captain to flag rank is treated as a loss to the system. The general expression for the rank of captain is:

$$
\begin{aligned}
R6(U,K) &= 0 && \text{if } U \leq K,\\
&= [1-L6(1)]Q6(1) && \text{if } U=K+1,\\
&\qquad \text{where } Q6(N) = R6(K+N-1,K)+P6(N)Q5(N),\\
&= [1-L6(2)]Q6(2) && \text{if } U=K+2,\\
&\quad \vdots\\
&= [1-L6(NT6)]Q6(NT6) && \text{if } U=K+NT6,\\
&= 0 && \text{if } U>K+NT6.
\end{aligned}
$$

This can be simplified if it is assumed that only two opportunities are available for promotion to captain. The resulting simplified expression would be:

$$
\begin{aligned}
R6(U,K) &= 0 && \text{if } U\ K+T_{61},\\
&= [1-L6(T_{61})]Q6(T_{61}) && \text{if } U=T_{61}+K,\\
&= [1-L6(T_{62})]Q6(T_{62}) && \text{if } U=T_{62}+K,\\
&= [R6(K+T_{62},K)] \prod_{I=T_{62}+K+1}^{U}(1-L6(I-K)) && \\
& && \text{if } K+T_{62}<U\leq K+NT6,\\
&= 0 && \text{if } U>K+NT6,
\end{aligned}
$$

where T_{61} is the length of commissioned service to the first possible promotion point to captain and T_{62} is the length of service to the second possible promotion point to captain. The maximum length of commissioned service for a captain is NT6.

Five types of losses to the system are taken into account. First, there is the small fraction of officers that die on active duty or medically retire each year. Second, there is the large fraction that leave after obligated service expires. Third, there are those lieutenants, lieutenant commanders, and commanders who resign their commissions each year before becomming eligible to retire. Fourth, there are those lieutenant commanders, commanders, and captains who retire from active duty. Finally, there are those captains who are promoted to flag rank, which is considered a loss to the system in this model. Loss rates are considered constant over the appropriate applicable time span.

C. COMPUTATIONAL METHODS

Actual computation is a recursive process. Each year is determined from the previous year's total, and a new input is added to the system. Promotions occur before losses are deducted from the system. The basic equations for promotion to lieutenant (junior grade) are:

$$R2(I,K)' = R2(I-1,K)+P2(I-K)R1(I,K) ,$$

$$R1(I,K)' = (1-P2(I-K))R1(I-1,K).$$

The basic equations for promotion to lieutenant are:

$$R3(I,K)' = R3(I-1,K)+P3(I-K)R2(I,K)',$$

$$R2(I,K)'' = (1-P3(I-K))R2(I,K)'.$$

The basic equations for promotion to lieutenant commander are:

$$R4(I,K)' = R4(I-1,K)+P4(I-K)R3(I,K)',$$

$$R3(I,K)'' = (1-P4(I-K))R3(I,K)'.$$

The basic equations for promotion to commander are:

$$R5(I,K)' = R5(I-1,K)+P5(I-K)R4(I,K)',$$

$$R4(I,K)'' = (1-P5(I-K))R4(I,K)'.$$

The basic equations for promotion to captain are:

$$R6(I,K)' = R6(I-1,K)+P6(I-K)R5(I,K)',$$

$$R5(I,K)'' = (1-P6(I-K))R5(I,K)'.$$

After promotions are computed, the losses are deducted from the system. The basic equations are:

$$R1(I,K) = (1-L1(I-K))R1(I,K)'$$

$$RJ(I,K) = (1-LJ(I-K))RJ(I,K)'' \quad J=2,3,..,6.$$

Actual computation by the computer requires slightly modified equations from the ones given above. The computer implicitly keeps track of the current time I and the previous time I-1, hence the first subscript on the variable can be dropped. The equations for promotion to lieutenant (junior grade) are:

$$R2(K)' = R2(K)+P2(I-K)R1(K),$$

$$R1(K)' = (1-P2(I-K))R1(K).$$

Similar modifications are made to the other equations of promotion to the various other ranks. The basic equations for deducting losses are modified as shown below:

$$RJ(K) = (1-LJ(I-K))RJ(K)', \quad J=1,2,..,6.$$

The primes and double primes placed on the left and right hand sides of the equations do not appear in the actual computer program. The computer does not have difficulty distinguishing the term on the left hand side of the equation from the same term used in the right hand side. For example:

$$R1(K) = (1-L1(I-K))R1(K)$$

is logically correct for the computer. The primes and double primes are added as an aid to understanding the computations.

III. TIME IN GRADE MANPOWER PLANNING MODEL

A. INTRODUCTION

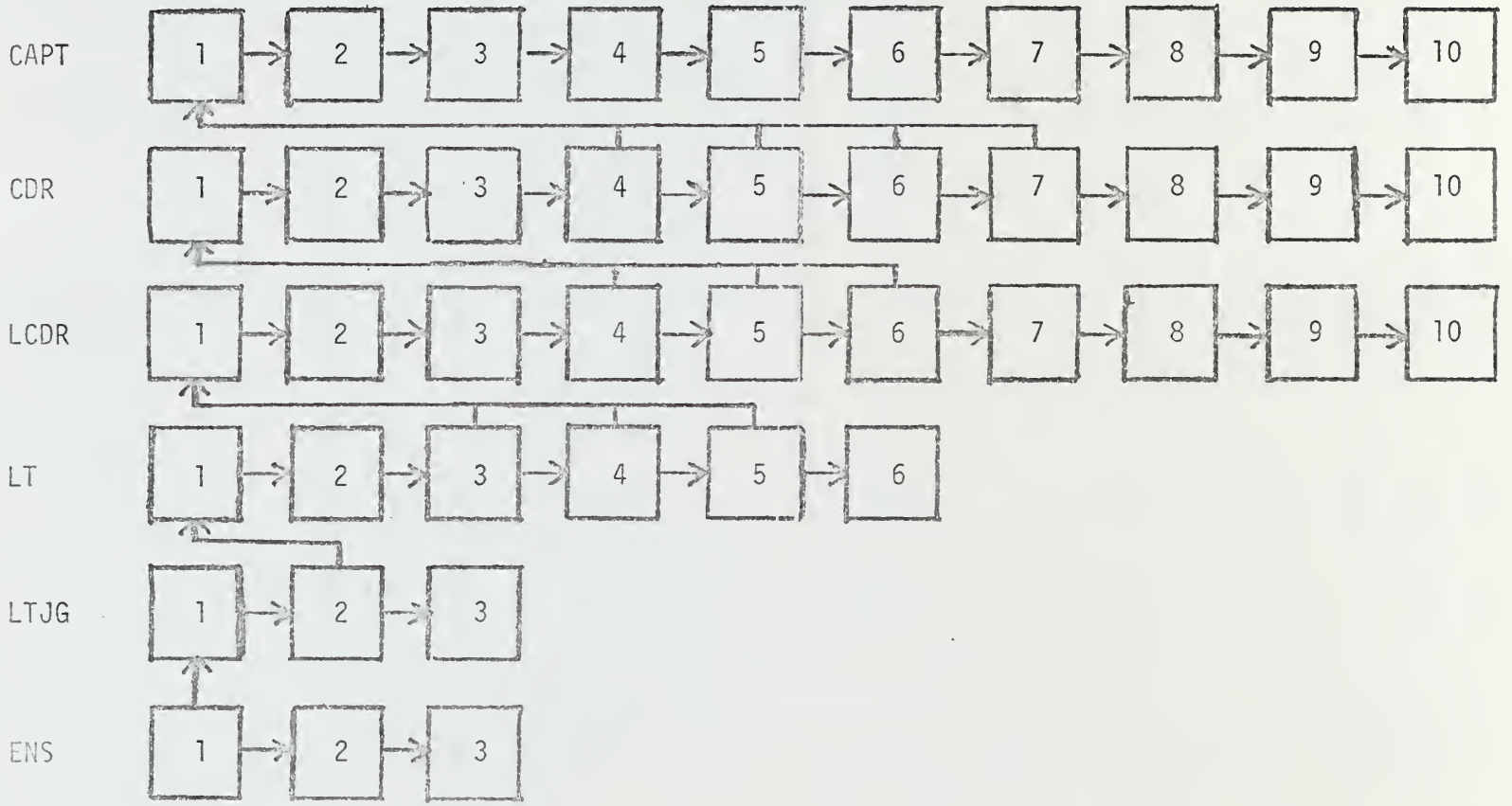
The Time in Grade Manpower Planning Model (TIG) is an alternative way to model the flow of officer personnel in the Navy. In this model, promotions are assumed to be a function of the total amount of time since the last promotion, or since commissioning in the case of ensigns. A typical personnel flowchart using this model is shown in Figure 3. The data used to construct this flowchart was a transformation of the data used in the previous flowchart shown in Figure 1. This transformed data is shown below:

	Due Course	Maximum Acceleration
Flag eligible	4 years	4 years
Captain	6-7 years	4-5 years
Commander	6 years	4 years
Lieutenant Commander	5 years	3 years
Lieutenant	2 years	2 years

Normal officer promotions occur after the time in grade labeled "Due Course." Exceptional performers can be promoted at any time from the maximum acceleration times to the normal due course times.

The TIG Manpower Planning Model also looks at the officer structure in discrete steps. The length of one step is one year. Each year one of three events can happen. First, the officer can remain in the same grade and advance one year of time in that grade. Second, the officer can be promoted into the first year in grade of the next highest rank. Finally, the officer can leave the system. The numbers of officers that qualify for each category are based on expected values, hence this model is deterministic rather than probabilistic.

Figure 3. Typical Time in Grade Officer Promotion Flowchart



As in the previous TIS Model, the TIG Manpower Planning Model considers promotions before losses. Each year all promotions are accomplished before any losses are taken from the system. Losses are a function of both rank and time in grade. The basic types of losses and the mathematical structure of the model are discussed in the following section.

B. MATHEMATICAL MODEL

Let R1(K,I) equal the number of ensigns in their I-th year in the grade of ensign present in year K. Let P2(I) be the proportion of ensigns in their I-th year in that grade who are promoted to lieutenant (junior grade). Let L1(I) be the proportion of ensigns in their I-th year in the grade not promoted who leave the system. Then:

$$R1(K,I) = \prod_{J=1}^{I-1}[1-L1(J)]\,[1-P2(J)]R1(K-I+1,1) \qquad \text{if } I>1,$$

where R1(N,1) is the initial input into the system for all N.

Similarly, let R2(K,I) equal the number of lieutenants (junior grade) in their I-th year in the grade of lieutenant (junior grade) present in year K. Let P3(I) be the proportion of lieutenants (junior grade) in their I-th year in that grade who are promoted to lieutenant. Let L2(I) be the proportion of lieutenants (junior grade) not promoted in their I-th year in that grade who leave the system. Then:

$$R2(K,1) = \sum_{J=1}^{NT1} P2(J)R1(K-1,J),$$

$$R2(K,I) = \prod_{J=1}^{I-1}[1-L2(J)]\,[1-P3(J)]R2(K-I+1,1) \qquad \text{if } I>1,$$

where NT1 is the maximum time in grade for an ensign.

Equivalent expressions can be developed for the ranks of lieutenant, lieutenant commander, and commander. For the rank of captain, the basic expressions are modified as in the previous time in service model. Promotion to flag rank is treated as a loss to the system because this model only examines the ranks from ensign to captain. The basic equations for captain are:

$$R6(K,1) = \sum_{J=1}^{NT5} P6(J)R5(K-1,J),$$

$$R6(K,I) = \prod_{J=1}^{I-1} [1-L6(J)]R6(K-I+1,1) \qquad \text{if } I>1,$$

where NT5 is the maximum time in grade for commander.

Losses to the system are treated the same way as in the previous time in service model. Five types of losses to the system are taken into account. First, there is the small fraction of officers that die on active duty or medically retire each year. Second, there is the large fraction of officers that leave the system after obligated service expires. Third, there are those lieutenants, lieutenant commanders, and commanders who resign their commissions each year before becoming eligible to retire. Fourth, there are those lieutenant commanders, commanders, and captains who retire each year. Finally, there are those captains who are promoted to flag rank which is considered a loss to the system in this model. Loss rates are considered constant over the appropriate applicable time span.

Losses are deducted from the system after promotions occur. If losses were to occur at the same time as promotions, then the

equations would have to be modified as in the following example for ensigns:

$$R1(K,I) = \prod_{J=1}^{I-1} [1-L1(J)-P2(J)]R1(K-I+1,1)$$

where $L1(J)+P2(J) \leq 1$ for all $J>1$.

C. COMPUTATIONAL METHODS

The actual computation for the time in grade model is a recursive process. The totals for each year are determined from the previous year's totals, and a new initial input is added to the system. As in the previous model, promotions occur before losses are deducted from the system.

The basic equations for promotion to lieutenant (junior grade) are:

$$R2(K,1)' = \sum_{I=1}^{NT1} P2(I)R1(K-1,I),$$

$$R1(K,I)' = [1-P2(I-1)]R1(K-1,I-1) \qquad I=2,\ldots,NT1,$$

where NT1 is the maximum time in the grade of ensign.

The basic equations for promotion to lieutenant are:

$$R3(K,1)' = \sum_{I=1}^{NT2} P3(I)R2(K-1,I),$$

$$R2(K,I)' = [1-P3(I-1)]R2(K-1,I-1) \qquad I=2,\ldots,NT2,$$

where NT2 is the maximum time in the grade of lieutenant (junior grade).

The basic equations for promotion to lieutenant commander are:

$$R4(K,1)' = \sum_{I=1}^{NT3} P4(I)R3(K-1,I),$$

$$R3(K,I)' = [1-P4(I-1)]R3(K-1,I-1) \qquad I=2,\ldots NT3,$$

where NT3 is the maximum time in the grade of lieutenant.

The basic equations for promotion to commander are:

$$R5(K,1)' = \sum_{I=1}^{NT4} P5(I)R4(K-1,I),$$

$$R4(K,I)' = [1-P5(I-1)]R4(K-1,I-1) \qquad I=2,\ldots,NT4,$$

where NT4 is the maximum time in the grade of lieutenant commander.

The basic equations for promotion to captain are:

$$R6(K,1)' = \sum_{I=1}^{NT5} P6(I)R5(K-1,I),$$

$$R5(K,I)' = [1-P6(I-1)]R5(K-1,I-1) \qquad I=2,\ldots,NT5,$$

$$R6(K,I)' = R6(K-1,I-1) \qquad I=2,\ldots,NT6,$$

where NT5 and NT6 are the maximum times in the grades of commander and captain respectively.

After promotions occur, losses are subtracted from the system. The basic equations are:

$$RJ(K,I) = [1-LJ(I)]RJ(K,I)' \qquad I=1,\ldots,NTJ, \qquad J=1,2,\ldots,6.$$

The primes on the left and right hand sides of the equations do not appear in the actual computer program. They are added, as in the previous model, to aid in the understanding of the computations.

IV. SAMPLE OUTPUTS

The following pages contain a sample output from the Time in Service Manpower Planning Model and a sample output from the Time in Grade Manpower Planning Model. The outputs were obtained from actual computer runs. The form is the same as that which would appear on the policy planner's computer terminal with one exception. The exception is that the format of the officer structure table in the Time in Grade Manpower Planning Model was altered slightly to fit on the thesis page. The number of officers and the promotion policy examined are examples only and do not necessarily reflect the current officer structure or promotion policy.

For clarity, those items of the program typed in by the policy planner are shown underlined in the following samples. The actual computing time on each one was less than 2 seconds.

EXECUTION BEGINS...

********** TIME IN SERVICE MANPOWER PLANNING MODEL **********

DO YOU DESIRE A PRINTOUT OF THE CURRENT OFFICER STRUCTURE? YES=1. NO=0.
1.

OFFICER STRUCTURE 1971

SERVICE DATE	ENS	LTJG	LT	LCDR	CDR	CAPT
1941	0.	0.	0.	0.	0.	34.
1942	0.	0.	0.	0.	0.	59.
1943	0.	0.	0.	0.	0.	120.
1944	0.	0.	1.	0.	0.	183.
1945	0.	0.	0.	0.	13.	136.
1946	0.	0.	0.	1.	87.	275.
1947	0.	0.	0.	0.	309.	590.
1948	0.	0.	0.	6.	525.	485.
1949	0.	0.	0.	68.	568.	337.
1950	0.	0.	1.	70.	779.	56.
1951	0.	0.	0.	174.	846.	30.
1952	0.	0.	0.	117.	844.	44.
1953	0.	0.	1.	174.	869.	28.
1954	0.	0.	0.	324.	572.	27.
1955	0.	0.	0.	467.	652.	11.
1956	0.	0.	0.	778.	157.	4.
1957	0.	0.	4.	783.	58.	2.
1958	0.	0.	23.	1029.	34.	0.
1959	0.	0.	21.	1239.	14.	0.
1960	0.	0.	81.	1162.	4.	0.
1961	0.	1.	856.	977.	7.	0.
1962	0.	0.	1746.	189.	4.	0.
1963	0.	0.	1894.	79.	2.	0.
1964	0.	0.	1936.	36.	1.	0.
1965	0.	8.	1781.	10.	4.	0.
1966	0.	36.	2333.	2.	2.	0.
1967	0.	3434.	490.	4.	0.	0.
1968	0.	5756.	42.	6.	2.	0.

1969	6576.	0.	11.	1.	1.	0.
1970	6422.	0.	5.	1.	0.	0.
TOTAL	12998.	9308.	10842.	7096.	5184.	2408.

TYPE THE YEAR YOU DESIRE TO PREDICT. EX. 1985

1971

THE PRESENT NUMBERS OF OFFICERS WITH EACH SERVICE DATE OR ITS EQUIVALENT HAVE BEEN SHOWN ABOVE. THE FUTURE NUMBER OF OFFICERS WITH EACH SERVICE DATE 10 YEARS FROM NOW WILL BE PREDICTED. ANSWER YES/NO QUESTIONS AS DIRECTED. ANSWER WHEN/WHAT FRACTION QUESTIONS WITH A 2 DIGIT INTEGER NEAREST THE TOTAL LENGTH OF COMMISSIONED SERVICE, THEN LEAVE 1 SPACE BLANK AND TYPE THE APPROPRIATE DECIMAL FRACTION. EX. OS .75 ALL TIMES REFER TO THE TOTAL LENGTH OF COMMISSIONED SERVICE UNLESS OTHERWISE SPECIFIED. WE ARE NOW READY TO BEGIN.

HOW MANY NEW ENS. ARE COMMISSIONED EACH YEAR?

1361.

WHEN AND WHAT FRACTION OF ENS. ARE PROMOTED TO LTJG?

2 1.0

WHEN AND WHAT FRACTION OF LTJG ARE PROMOTED TO LT?

2 .95

WHEN AND WHAT FRACTION OF LT ARE PROMOTED TO LCDR?

2 .90

ANY EARLY PROMOTIONS TO LCDR? YES=1. NO=0.

1.

WHEN AND WHAT FRACTION OF LT ARE PROMOTED EARLY TO LCDR?

2 .05

ANY OTHER EARLY PROMOTIONS TO LCDR? YES=1. NO=0.

0.

ANY LATE PROMOTIONS TO LCDR? YES=1. NO=0.

0.

WHEN AND WHAT FRACTION OF LCDR ARE PROMOTED TO CDR?

1 .75

ANY EARLY PROMOTIONS TO CDR? YES=1. NO=0.

[illegible] AND WHAT FRACTION OF LCDR ARE PROMOTED EARLY TO CDR?

1 .05

ANY OTHER EARLY PROMOTIONS TO CDR? YES=1. NO=0.

0.
ANY LATE PROMOTIONS TO CDR? YES=1. NO=0.

0.
WHEN AND WHAT FRACTION OF CDR ARE PROMOTED TO CAPT?
2 .44
ANY EARLY PROMOTIONS TO CAPT? YES=1. NO=0.
1.
WHEN AND WHAT FRACTION OF CDR ARE PROMOTED EARLY TO CAPT?
1 .05
ANY OTHER EARLY PROMOTIONS TO CAPT? YES=1. NO=0.
0.
ANY LATE PROMOTIONS TO CAPT? YES=1. NO=0.
0.
WHAT IS THE MAXIMUM LENGTH OF COMMISSIONED SERVICE FOR ENS?
03
FOR LTJG?
05
FOR LT?
10
FOR LCDR?
16
FOR CDR?
22
FOR CAPT?
30

WHEN A CHANGE IN PROMOTION POLICY OCCURS SO THAT THE TIME IN SERVICE FOR ANY PROMOTION IS DECREASED, THE POSSIBILITY ALSO OCCURS THAT SOME YEAR GROUP WILL MISS ITS PRIMARY CHANCE FOR PROMOTION. TO CORRECT FOR THIS ERROR, THIS PROGRAM ALLOWS A FRACTION OF THAT YEAR GROUP TO BE SPOT PROMOTED TO THE NEXT HIGHEST GRADE.
DO YOU DESIRE TO SPOT PROMOTE ANY YEAR GROUP OF ENS? YES=1. NO=0.
0
DO YOU DESIRE TO SPOT PROMOTE ANY YEAR GROUP OF LTJG? YES=1. NO=0.
0
TYPE THE SERVICE DATE (4 DIGITS) OF THAT YEAR GROUP.

1967
WHAT FRACTION DO YOU DESIRE TO SPOT PROMOTE?
.15
DO YOU DESIRE TO SPOT PROMOTE ANY OTHER YEAR GROUP OF LTJG? YES=1. NO=0.
0.
DO YOU DESIRE TO SPOT PROMOTE ANY YEAR GROUP OF LT? YES=1. NO=0.
1.
TYPE THE SERVICE DATE (4 DIGITS) OF THAT YEAR GROUP.
1962
WHAT FRACTION DO YOU DESIRE TO SPOT PROMOTE?
.30
DO YOU DESIRE TO SPOT PROMOTE ANY OTHER YEAR GROUP OF LT? YES=1. NO=0.
1.
TYPE THE SERVICE DATE (4 DIGITS) OF THAT YEAR GROUP.
1961
WHAT FRACTION DO YOU DESIRE TO SPOT PROMOTE?
.5
DO YOU DESIRE TO SPOT PROMOTE ANY OTHER YEAR GROUP OF LT? YES=1. NO=0.
0.
DO YOU DESIRE TO SPOT PROMOTE ANY YEAR GROUP OF LCDR? YES=1. NO=0.
1.
TYPE THE SERVICE DATE (4 DIGITS) OF THAT YEAR GROUP.
1956
WHAT FRACTION DO YOU DESIRE TO SPOT PROMOTE?
.75
DO YOU DESIRE TO SPOT PROMOTE ANY OTHER YEAR GROUP OF LCDR? YES=1. NO=0.
0.
DO YOU DESIRE TO SPOT PROMOTE ANY YEAR GROUP OF CDR? YES=1. NO=0.
1.
TYPE THE SERVICE DATE (4 DIGITS) OF THAT YEAR GROUP.
1950
WHAT FRACTION DO YOU DESIRE TO SPOT PROMOTE?
1.
DO YOU DESIRE TO SPOT PROMOTE ANY OTHER YEAR GROUP OF CDR? YES=1. NO=0.
0.

NOW CONSIDER LOSSES TO THE SYSTEM.
WHAT FRACTION OF OFFICERS DIE OR RETIRE MEDICALLY EACH YEAR?
.02
WHAT IS THE LENGTH OF OBLIGATED SERVICE?
2
WHAT FRACTION QUIT AFTER OBLIGATED SERVICE?
.1
WHAT FRACTION OF LT RESIGN EACH YEAR?
.15
WHAT FRACTION OF LCDR RESIGN EACH YEAR PRIOR TO RETIREMENT?
.10
WHAT FRACTION OF EACH YEAR GROUP OF CDR RESIGN EACH YEAR PRIOR TO MANDATORY RETIREMENT?
.05
WHAT FRACTION OF EACH YEAR GROUP OF LCDR RETIRE EACH YEAR PRIOR TO MANDATORY RETIREMENT?
.1
WHAT FRACTION OF EACH YR GROUP OF CDR RETIRE EACH YEAR PRIOR TO MANDATORY RETIREMENT?
.15
WHAT FRACTION OF EACH YR GROUP OF CAPT RETIRE EACH YEAR PRIOR TO MANDATORY RETIREMENT?
.1
WHEN AND WHAT FRACTION OF CAPT ARE PROMOTED TO FLAG?
25 .10

OFFICER STRUCTURE 1981

SERVICE DATE	ENS	LTJG	LT	LCDR	CDR	CAPT
1952	0.	0.	0.	0.	0.	60.
1953	0.	0.	0.	0.	0.	61.
1954	0.	0.	0.	0.	0.	93.
1955	0.	0.	0.	0.	70.	102.
1956	0.	0.	0.	0.	90.	116.
1957	0.	0.	0.	0.	87.	117.
1958	0.	0.	0.	0.	113.	145.
1959	0.	0.	0.	0.	147.	106.
1960	0.	0.	0.	0.	144.	150.
1961	0.	0.	0.	6.	158.	151.
1962	0.	0.	0.	102.	439.	24.
1963	0.	0.	0.	104.	442.	0.

1964	0.	0.	0.	89.	360.	
1965	0.	0.	0.	93.	357.	0.
1966	0.	0.	0.	123.	444.	0.
1967	0.	0.	0.	106.	362.	0.
1968	0.	0.	0.	707.	40.	0.
1969	0.	0.	0.	939.	1.	0.
1970	0.	0.	0.	1021.	0.	0.
1971	0.	0.	0.	1172.	0.	0.
1972	0.	0.	140.	1332.	0.	0.
1973	0.	0.	159.	1514.	0.	0.
1974	0.	0.	1806.	95.	0.	0.
1975	0.	0.	2160.	0.	0.	0.
1976	0.	144.	2455.	0.	0.	0.
1977	0.	147.	2790.	0.	0.	0.
1978	0.	306.	5812.	0.	0.	0.
1979	0.	6243.	0.	0.	0.	0.
1980	6370.	0.	0.	0.	0.	0.
1981	6500.	0.	0.	0.	0.	0.
TOTAL	12870.	6839.	15322.	7405.	3258.	2444.

```
EXECUTION BEGINS...
 ************  TIME IN GRADE MANPOWER PLANNING MODEL  ************

DO YOU DESIRE TO SEE THE CURRENT STATE OF THE SYSTEM? YES=1. NO=0.

1.

                              OFFICER STRUCTURE 1971
RANK                               TIME IN GRADE
          1     2     3     4     5     6     7     8     9    10  TOTAL
ENS    6422. 6576.    0.    0.    0.    0.    0.    0.    0.    0. 12998.
LTJG   5755. 3454.   90.    8.    0.    0.    0.    0.    0.    0.  9307.
LT     2333. 1761. 1656. 1084. 1746.  856.   81.   21.   23.    4. 10375.
LCDR    977. 1162. 1239. 1020.  783.  778.  467.  324.  174.  117.  7368.
CDR     652.  572.  369.  344.  646.  779.  598.  525.  309.   87.  4894.
CAPT    337.  485.  590.  275.  166.  183.  176.   59.   34.    0.  2275.
 TYPE THE YEAR YOU DESIRE TO PREDICT. EX. 1985

2001

     BY ANSWERING THE FOLLOWING QUESTIONS THE OFFICER STRUCTURE WILL BE PREDICTED
FOR 2001.  ALL TIMES REFER TO TIME IN GRADE (2 DIGITS) UNLESS OTHERWISE SPECIFIED.
WHEN AND WHAT FRACTION QUESTIONS ARE ANSWERED BY TYPING THE TIME IN GRADE (2 DIGITS),
LEAVING 1 SPACE BLANK, AND THEN TYPING THE DECIMAL FRACTION. EX. 02 .95

WE ARE NOW READY TO BEGIN.
HOW MANY NEW ENS ARE COMMISSIONED EACH YEAR?
6.06.
WHEN AND WHAT FRACTION OF ENS ARE PROMOTED TO LTJG?
 1.0
WHEN AND WHAT FRACTION OF LTJG ARE PROMOTED TO LT?
 .93
WHEN IS THE FIRST PROMOTION TO LCDR AND WHAT FRACTION ARE PROMOTED?
 .05
ARE THERE OTHER PROMOTIONS TO LCDR? YES=1. NO=0.
1.
WHEN IS THE NEXT PROMOTION TO LCDR AND WHAT FRACTION ARE PROMOTED?
 .90
ARE THERE OTHER PROMOTIONS TO LCDR? YES=1. NO=0.
```

0.
WHEN IS THE FIRST PROMOTION TO CDR AND WHAT FRACTION ARE PROMOTED?
10 .05
ANY OTHER PROMOTIONS TO CDR? YES=1. NO=0.
1.
WHEN IS THE NEXT PROMOTION TO CDR AND WHAT FRACTION ARE PROMOTED?
17 .75
ANY OTHER PROMOTIONS TO CDR? YES=1. NO=0.
0.
WHEN IS THE FIRST PROMOTION TO CAPT AND WHAT FRACTION ARE PROMOTED?
[illegible] .15
ANY OTHER PROMOTIONS TO CAPT? YES=1. NO=0.
1.
WHEN IS THE NEXT PROMOTION TO CAPT AND WHAT FRACTION ARE PROMOTED?
[illegible] .44
ANY OTHER PROMOTIONS TO CAPT? YES=1. NO=0.
0.
WHEN A CHANGE IN PROMOTION POLICY OCCURS SO THAT THE TIME IN GRADE FOR ANY PROMOTION IS DECREASED, THE POSSIBILITY EXISTS THAT SOME GROUP OF OFFICERS WILL MISS THEIR PRIMARY CHANCE FOR PROMOTION. TO CORRECT FOR THIS ERROR, THIS PROGRAM ALLOWS A FRACTION OF THAT GROUP TO BE SPOT PROMOTED TO THE NEXT HIGHEST RANK.
DO YOU DESIRE TO SPOT PROMOTE ANY GROUP OF ENS? YES=1. NO=0.
0.
DO YOU DESIRE TO SPOT PROMOTE ANY GROUP OF LTJG? YES=1. NO=0.
1.
DO YOU DESIRE TO SPOT PROMOTE ANY GROUP OF LT? YES=1. NO=0.
1.
TYPE THE TIME IN GRADE (2 DIGITS) OF THE GROUP TO BE SPOT PROMOTED.
[illegible]
WHAT FRACTION DO YOU DESIRE TO SPOT PROMOTE?
[illegible]
DO YOU DESIRE TO SPOT PROMOTE ANY OTHER GROUP OF LT? YES=1. NO=0.
[illegible]
DO YOU DESIRE TO SPOT PROMOTE ANY GROUP OF LCDR? YES=1. NO=0.
[illegible]

TYPE THE TIME IN GRADE (2 DIGITS) OF THE GROUP TO BE SPOT PROMOTED.
06
...HAT FRACTION DO YOU DESIRE TO SPOT PROMOTE?
.75
DO YOU DESIRE TO SPOT PROMOTE ANY OTHER GROUP OF LCDR? YES=1. NO=0.
0.
DO YOU DESIRE TO SPOT PROMOTE ANY GROUP OF CDR? YES=1. NO=0.
0.
NOW CONSIDER LOSSES TO THE SYSTEM.
...HAT RANK DOES OBLIGATED SERVICE EXPIRE IN? ENS=1. LTJG=2. LT=3.
3.
AFTER WHAT TIME IN THAT RANK DOES OBLIGATED SERVICE EXPIRE?
.21
...AT FRACTION LEAVE AT THE END OF OBLIGATED SERVICE?
.06
...AT FRACTION DIE OR MEDICALLY RETIRE EACH YEAR?
.04
...AT FRACTION OF LT RESIGN EACH YR AFTER OBLIGATED SERVICE?
.10
...AT FRACTION OF LCDR RESIGN EACH YR PRIOR TO RETIREMENT?
.16
AFTER WHAT TIME IN GRADE ARE LCDR ELIGIBLE TO RETIRE?
1
...HAT FRACTION OF THOSE LCDR ELIGIBLE RETIRE EACH YR?
.25
...AT FRACTION OF CDR RESIGN EACH YR PRIOR TO RETIREMENT?
.16
AFTER WHAT TIME IN GRADE ARE CDR ELIGIBLE TO RETIRE?
1
...AT FRACTION OF THOSE CDR ELIGIBLE RETIRE EACH YR?
...AT FRACTION OF THOSE CAPT ELIGIBLE RETIRE EACH YR?
...AND WHAT FRACTION OF CAPT ARE PROMOTED TO FLAG?
.2 .10

WHAT IS THE MAXIMUM TIME IN GRADE FOR ENS?
03
FOR LTJG?
06
FOR LT?
05
FOR LCDR?
12
FOR CDR?
10
FOR CAPT?
10

OFFICER STRUCTURE 2001
TIME IN GRADE

RANK	1	2	3	4	5	6	7	8	9	10	TOTAL
ENS	6370.	6243.	0.	0.	0.	0.	0.	0.	0.	0.	12613.
LTJG	6113.	5995.	294.	0.	0.	0.	0.	0.	0.	0.	12407.
LT	2734.	2406.	2117.	1770.	156.	0.	0.	0.	0.	0.	9183.
LCDR	1435.	1316.	1158.	1019.	897.	789.	660.	145.	128.	112.	7824.
CDR	470.	414.	364.	320.	282.	195.	80.	58.	43.	31.	2257.
CAPT	90.	81.	73.	66.	53.	47.	43.	38.	34.	31.	556.

APPENDIX A. LIST AND DEFINITIONS OF VARIABLES USED IN THE TIME IN SERVICE MANPOWER PLANNING MODEL

This appendix lists and defines the principal variables used in the Time in Service Manpower Planning Model.

Variable	Definition
TENS(K)	The current number of ENS who were commissioned in year K.
TLTJG(K)	Same as above for LTJG.
TLT(K)	Same as above for LT.
TLCDR(K)	Same as above for LCDR.
TCDR(K)	Same as above for CDR.
TCAPT(K)	Same as above for CAPT.
PLTJG(K)	The fraction of officers promoted to LTJG K years after commissioning.
PLT(K)	Same as above for LT.
PLCDR(K)	Same as above for LCDR.
PCDR(K)	Same as above for CDR.
PCAPT(K)	Same as above for CAPT.
RLOS1(K)	The fraction of officers in the rank of ENS that leave the system K years after commissioning.
RLOS2(K)	Same as above for LTJG.
RLOS3(K)	Same as above for LT.
RLOS4(K)	Same as above for LCDR.
RLOS5(K)	Same as above for CDR.
RLOS6(K)	Same as above for CAPT.
S2(K)	The number of officers spot promoted to LTJG who were commissioned in year K.

S3(K)	Same as above for LT.
S4(K)	Same as above for LCDR.
S5(K)	Same as above for CDR.
S6(K)	Same as above for CAPT.
KHZN	The year to be predicted.
ENS	The number of ensigns commissioned each year in the future.
LE1, L1,LL1	Early, normal, and late promotion points for promotion to LTJG.
LE2, L2, LL2	Same as above for LT.
LE3, L3, LL3	Same as above for LCDR.
LE4, L4, LL4	Same as above for CDR.
LE5, L5, LL5	Same as above for CAPT.
PE1, P1, PL1	Early, normal, and late promotion probabilities for promotion to LTJG.
PE2, P2, PL2	Same as above for LT.
PE3, P3, PL3	Same as above for LCDR.
PE4, P4, PL4	Same as above for CDR.
PE5, P5, PL5	Same as above for CAPT.
NT1, NT2, NT3, NT4, NT5, NT6	Maximum length of commissioned service in each rank.
KG1, F1	Service date and the fraction of officers spot promoted to LTJG.
KG2, F2	Same as above for LT.
KG3, F3	Same as above for LCDR.
KG4, F4	Same as above for CDR.
KG5, F5	Same as above for CAPT.
A	The fraction of officers that die or medically retire each year.

LOS	The length of obligated service.
B	The fraction of officers that leave after obligated service.
C3	The fraction of LT that resign each year.
C4	Same as above for LCDR.
C5	Same as above for CDR.
R1	The fraction of eligible LCDR that retire each year prior to the time of mandatory retirement.
R2	Same as above for CDR.
R3	Same as above for CAPT.
L7, F	The length of commissioned service and the fraction of CAPT promoted to flag rank.
Q1, etc.	The answers to yes/no questions.

APPENDIX B. LIST AND DEFINITIONS OF VARIABLES USED IN THE TIME IN GRADE MANPOWER PLANNING MODEL

This appendix lists and defines the principal variables used in Time in Grade Manpower Planning Model.

Variable	Definition
R1(K,I)	The number of ENS in their I-th year as ENS present in year K.
R2(K,I)	Same as above for LTJG.
R3(K,I)	Same as above for LT.
R4(K,I)	Same as above for LCDR.
R5(K,I)	Same as above for CDR.
R6(K,I)	Same as above for CAPT.
P2(I)	The fraction of officers promoted to LTJG in their I-th year in their present grade.
P3(I)	Same as above for LT.
P4(I)	Same as above for LCDR.
P5(I)	Same as above for CDR.
P6(I)	Same as above for CAPT.
RLOS1(I)	The fraction of ENS in their I-th year as ENS that leave the system.
RLOS2(I)	Same as above for LTJG.
RLOS3(I)	Same as above for LT.
RLOS4(I)	Same as above for LCDR.
RLOS5(I)	Same as above for CDR.
RLOS6(I)	Same as above for CAPT.
S2(I)	The number of ENS in their I-th year as ENS spot promoted to the next rank.

S3(I)	Same as above for LTJG.
S4(I)	Same as above for LT.
S5(I)	Same as above for LCDR.
S6(I)	Same as above for CDR.
NP	The year to be predicted.
ENS	The number of new ensigns commissioned each year in the future.
K2, PLTJG	The promotion point and fraction for promotion to LTJG.
K3, PLT	Same as above for LT.
K4, PLCDR	Same as above for LCDR.
K5, PCDR	Same as above for CDR.
K6, PCAPT	Same as above for CAPT.
J1, F1	The time in grade and fraction of ENS being spot promoted.
J2, F2	Same as above for LTJG.
J3, F3	Same as above for LT.
J4, F4	Same as above for LCDR.
J5, F5	Same as above for CDR.
ROS	The rank in which obligated service expires.
LOS	The length of obligated service.
A	The fraction of officer that die or medically retire each year.
B	The fraction of officers that resign after obligated service expires.
C1	The fraction of LT that resign each year.
C2	Same as above for LCDR.
C3	Same as above for CDR.

KR1	The minimum length of time in grade for retirement as a LCDR.
KR2	Same as above for CDR.
D1	The fraction of LCDR that retire each year prior to mandatory retirement.
D2	Same as above for CDR.
D3	Same as above for CAPT.
KF, FLAG	The length of time in grade and fraction of CAPT promoted to flag rank.
NT1, NT2, NT3, NT4, NT5, NT6	Maximum times is grade for each rank.
Q1, etc.	The answers to yes/no questions.

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**********************************************************************
*********  TIME IN SERVICE MANPOWER PLANNING MODEL  *******************
**********************************************************************
*********  FRANK JILLIAN REIFSNYDER, JR.  ********************************
**********************************************************************
**********************************************************************

**********  FORMAT SECTION  **********

      DIMENSION TENS(60), TLTJG(60), TLT(60), TLCDR(60), TCDR(60),
     1TCAPT(60), PLTJG(30), PLT(30), PLCDR(30), PCDR(30), PCAPT(30),
     2RLOS1(30),RLOS2(30),RLOS3(30),RLOS4(30),RLOS5(30),RLOS6(30),
     3S2(30),S3(30),S4(30),S5(30),S6(30)
    9 FORMAT (1X,'DO YOU DESIRE A PRINTOUT OF THE CURRENT OFFICER STRUCT
     1URE? YES=1, NO=0.')
   10 FORMAT (6X,'THE PRESENT NUMBERS OF OFFICERS WITH EACH SERVICE ', '
     1DATE OR ITS EQUIVALENT HAVE',/,1X,'BEEN SHOWN ABOVE.  THE FUTURE N
     2UMBER OF OFFICERS WITH EACH SERVICE DATE ',I2,' YEARS',/,1X,'FROM
     3NOW WILL BE PREDICTED.  ANSWER YES/NO QUESTIONS AS DIRECTED.  ANSW
     4ER WHEN/WHAT',/,1X,'FRACTION QUESTIONS WITH A 2 DIGIT INTEGER NEAR
     5EST THE TOTAL LENGTH OF COMMISSIONED'./,1X,'SERVICE, THEN LEAVE 1
     6SPACE BLANK AND TYPE THE APPROPRIATE DECIMAL FRACTION.  EX. 12 .75'
     7,/,1X,'ALL TIMES REFER TO THE TOTAL LENGTH OF COMMISSIONED SERVICE
     8 UNLESS OTHERWISE SPECIFIED.')
   11 FORMAT (1X,'WE ARE NOW READY TO BEGIN.')
   12 FORMAT (1X,'HOW MANY NEW ENS. ARE COMMISSIONED EACH YEAR?')
   13 FORMAT (F1 .3)
   14 FORMAT (1X,'WHEN AND WHAT FRACTION OF ENS. ARE PROMOTED TO LTJG?')
   15 FORMAT (I2,1X,F5.3)
   16 FORMAT (1X,'WHEN AND WHAT FRACTION OF LTJG ARE PROMOTED TO LT?')
   17 FORMAT (1X,'WHEN AND WHAT FRACTION OF LT ARE PROMOTED TO LCDR?')
   18 FORMAT (1X,'ANY EARLY PROMOTIONS TO LCDR? YES=1. NO=0.')
   19 FORMAT (F4.1)
   20 FORMAT (1X,'WHEN AND WHAT FRACTION OF LT ARE PROMOTED EARLY TO LCD
     1R?')
   21 FORMAT (1X,'ANY OTHER EARLY PROMOTIONS TO LCDR? YES=1. NO=0.')
   22 FORMAT (1X,'ANY LATE PROMOTIONS TO LCDR? YES=1. NO=0.')
   23 FORMAT (1X,'WHEN AND WHAT FRACTION OF LT ARE PROMOTED LATE TO LCDR
     1?')
   24 FORMAT (1X,'ANY OTHER LATE PROMOTIONS TO LCDR? YES=1. NO=0.')
   25 FORMAT (1X,'WHEN AND WHAT FRACTION OF LCDR ARE PROMOTED TO CDR?')
   26 FORMAT (1X,'ANY EARLY PROMOTIONS TO CDR? YES=1. NO=0.')
   27 FORMAT (1X,'WHEN AND WHAT FRACTION OF LCDR ARE PROMOTED EARLY TO
     1CDR?')
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28 FORMAT (1X,'ANY OTHER EARLY PROMOTIONS TO CDR? YES=1. NO=0.')
29 FORMAT (1X,'ANY LATE PROMOTIONS TO CDR? YES=1. NO=0.')
30 FORMAT (1X,'WHEN AND WHAT FRACTION OF LCDR ARE PROMOTED LATE TO CD
  1R?')
31 FORMAT (1X,'ANY OTHER LATE PROMOTIONS TO CDR? YES=1. NO=0.')
32 FORMAT (1X,'WHEN AND WHAT FRACTION OF CDR ARE PROMOTED TO CAPT?')
33 FORMAT (1X,'ANY EARLY PROMOTIONS TO CAPT? YES=1. NO=0.')
34 FORMAT (1X,'WHEN AND WHAT FRACTION OF CDR ARE PROMOTED EARLY TO CA
  1PT?')
35 FORMAT (1X,'ANY OTHER EARLY PROMOTIONS TO CAPT? YES=1. NO=0.')
36 FORMAT (1X,'ANY LATE PROMOTIONS TO CAPT? YES=1. NO=0.')
37 FORMAT (1X,'WHEN AND WHAT FRACTION OF CDR ARE PROMOTED LATE TO CAP
  1T?')
38 FORMAT (1X,'ANY OTHER LATE PROMOTIONS TO CAPT? YES=1. NO=0.')
39  FORMAT (1X,'WHAT IS THE MAXIMUM LENGTH OF COMMISSIONED SERVICE FO
  1R ENS?')
40 FORMAT (I2)
41 FORMAT (1X,'FOR LTJG?')
42 FORMAT (1X,'FOR LT?')
43 FORMAT (1X,'FOR LCDR?')
44 FORMAT (1X,'FOR CDR?')
45 FORMAT (1X,'FOR CAPT?')
46 FORMAT (1X,'NOW CONSIDER LOSSES TO THE SYSTEM.')
47 FORMAT (1X,'WHAT FRACTION OF OFFICERS DIE OR RETIRE MEDICALLY EACH
  1 YEAR?')
48 FORMAT (F5.3)
49 FORMAT (1X,'WHAT IS THE LENGTH OF OBLIGATED SERVICE?')
50 FORMAT (1X,'WHAT FRACTION QUIT AFTER OBLIGATED SERVICE?')
51 FORMAT (1X,'WHAT FRACTION OF LT RESIGN EACH YEAR?')
52 FORMAT (1X,'WHAT FRACTION OF LCDR RESIGN EACH YEAR PRIOR TO RETIRE
  1MENT?')
53 FORMAT (1X,'WHAT FRACTION OF EACH YEAR GROUP OF LCDR RETIRE EACH Y
  1EAR PRIOR TO MANDATORY RETIREMENT?')
54 FORMAT (1X,'WHAT FRACTION OF EACH YR GROUP OF CDR RETIRE EACH YEAR
  1 PRIOR TO MANDATORY RETIREMENT?')
55 FORMAT (1X,'WHAT FRACTION OF EACH YR GROUP OF CAPT RETIRE EACH YEA
  1R PRIOR TO MANDATORY RETIREMENT?')
56 FORMAT (1X,'FLAG AND WHAT FRACTION OF CAPT ARE PROMOTED TO FLAG?')
58 FORMAT ('1',1X,'TYPE THE YEAR YOU DESIRE TO PREDICT. EX. 1985',/)
60 FORMAT (I4)
62 FORMAT ('1',1X,'**********  TIME IN SERVICE MANPOWER PLANNING MO
  1DEL  **********',/)
63 FORMAT (1X,'WHAT FRACTION OF EACH YEAR GROUP OF CDR RESIGN EACH YE
  1AR PRIOR TO MANDATORY RETIREMENT?')
64 FORMAT (1X,'IF A CHANGE IN PROMOTION POLICY OCCURS SO THAT THE T
  1IME IN SERVICE FOR ',/,1X,'ANY PROMOTION IS DECREASED, THE POSSIBI
  2LITY ARISES THAT SOME YEAR GROUP ',/,1X,'WILL MISS ITS PRIMAR
  3Y CHANCE FOR PROMOTION.  TO CORRECT FOR THIS ERROR, THIS ',/,1X,'P
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     4ROGRAM ALLOWS A FRACTION OF THAT YEAR GROUP TO BE SPOT PROMOTED TO
     5 THE NEXT ',/,1X,'HIGHEST GRADE.')
  65 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY YEAR GROUP OF ENS? Y
    1ES=1. NO=0.')
  66 FORMAT (1X,'TYPE THE SERVICE DATE (4 DIGITS) OF THAT YEAR GROUP.')
  67 FORMAT (1X,'WHAT FRACTION DO YOU DESIRE TO SPOT PROMOTE?')
  68 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY OTHER YEAR GROUP OF
    1ENS? YES=1. NO='.')
  69 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY YEAR GROUP OF LTJG?
    1YES=1. NO=.')
  7  FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY OTHER YEAR GROUP OF
    1LTJG? YES=1. NO=.')
  71 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY YEAR GROUP OF LT? YE
    1S=1. NO=.')
  72 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY OTHER YEAR GROUP OF
    1LT? YES=1. NO=.')
  73 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY YEAR GROUP OF LCDR?
    1YES=1. NO=.')
  74 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY OTHER YEAR GROUP OF
    1LCDR? YES=1. NO=.')
  75 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY YEAR GROUP OF CDR? Y
    1ES=1. NO=.')
  76 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY OTHER YEAR GROUP OF
    1CDR? YES=1. NO=.')
 10  FORMAT (6F10.3)
 3   FORMAT (5X,I4,5X,F5.,5X,F5.,5X,F5.,5X,F5.,5X,F5.,5X,F5.)
 302 FORMAT (1X,'TOTAL',7X,F6.,4X,F6.,4X,F6.,4X,F6.,4X,F6.,4X,F6.
    1)
 30  FORMAT ('1',23X,'OFFICER STRUCTURE ',I4,
    1/,1X,'SERVICE DATE',2X,'ENS',7X,'LTJG',7X,'LT',7X,'LCDR',6X,
    2'CDR',7X,'CAPT')

*********************  EXTERNAL INPUT SECTION  ***************************

      READ (3,1  ) (TENS(K),K=1,3 )
      READ (3,1  ) (TLTJG(K),K=1,3 )
      READ (3,1  ) (TLT(K),K=1,3 )
      READ (3,1  ) (TLCDR(K),K=1,3 )
      READ (3,1  ) (TCDR(K),K=1,3 )
      READ (3,1  ) (TCAPT(K),K=1,3 )

*********************  MAN/MACHINE INTERFACE SECTION  ************************

      WRITE (6,62)
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      WRITE (6,9)
      READ (5,19) Q13
      IF (Q13.EQ.3.) GO TO 57
      KYEAR=1971
      KSTART=KYEAR-31
      WRITE (6,3[illegible]) KYEAR
      DO 3 K=1,3[illegible]
      KK=K+KSTART
      WRITE (6,3[illegible]) KK,TENS(K),TLTJG(K),TLT(K),TLCDR(K),TCDR(K),TCAPT(K)
    3 CONTINUE
      SENS=0.
      SLTJG=0.
      SLT=0.
      SLCDR=0.
      SCDR=0.
      SCAPT=0.
      DO 61 K=1,3[illegible]
      SENS=SENS+TENS(K)
      SLTJG=SLTJG+TLTJG(K)
      SLT=SLT+TLT(K)
      SLCDR=SLCDR+TLCDR(K)
      SCDR=SCDR+TCDR(K)
      SCAPT=SCAPT+TCAPT(K)
   61 CONTINUE
      WRITE (6,3[illegible]2) SENS,SLTJG,SLT,SLCDR,SCDR,SCAPT
   57 WRITE (6,58)
   59 READ (5,60) KHZN
      KH=KHZN-KSTART
      DO 7 K=1,3[illegible]
      PLTJG(K)=0.
      PLT(K)=0.
      PLCDR(K)=0.
      PCDR(K)=0.
      PCAPT(K)=0.
    7 CONTINUE
      DO 8 K=31,KH
      TENS(K)=0.
      TLTJG(K)=0.
      TLT(K)=0.
      TLCDR(K)=0.
      TCDR(K)=0.
      TCAPT(K)=0.
    8 CONTINUE
      DO 119 K=1,3[illegible]
      SP(K)=0.
      S[illegible](K)=0.
      S[illegible](K)=0.
      S[illegible](K)=0.
```

```
      S6(K)=0.
  119 CONTINUE
      KFT=KHZN-KYEAR
      WRITE (6,10) KFT
      WRITE (6,11)
      WRITE (6,12)
      READ (5,13) ENS
      DO 5 K=31,KH
      TENS(K)=ENS
    5 CONTINUE
      WRITE (6,14)
      READ (5,15) L1,P1
      PLTJG(L1)=P1
      WRITE (6,16)
      READ (5,15) L2,P2
      PLT(L2)=P2
      WRITE (6,17)
      READ (5,15) L3,P3
      PLCOR(L3)=P3
      WRITE (6,18)
      READ (5,19) Q1
      IF (Q1.EQ.1.) GO TO 101
  102 WRITE (6,20)
      READ (5,15) LL3,PL3
      PLCOS(LL3)=PL3
      WRITE (6,21)
      READ (5,19) Q2
      IF (Q2.EQ.1.) GO TO 102
  101 WRITE (6,22)
      READ (5,19) Q3
      IF (Q3.EQ.1.) GO TO 104
  103 WRITE (6,23)
      READ (5,15) LL3,PL3
      PLCOR(LL3)=PL3
      WRITE (6,24)
      READ (5,19) Q4
      IF (Q4.EQ.1.) GO TO 103
  104 WRITE (6,25)
      READ (5,15) L4,P4
      PCOS(L4)=P4
      WRITE (6,26)
      READ (5,19) Q5
      IF (Q5.EQ.1.) GO TO 106
  105 WRITE (6,27)
      READ (5,15) LL4,PL4
      PCOS(LL4)=PL4
      WRITE (6,28)
      READ (5,19) Q6
```

```
      IF (Q6.EQ.1.) GO TO 106
  105 WRITE (6,29)
      READ (5,19) Q7
      IF (Q7.EQ.1.) GO TO 107
  106 WRITE (6,30)
      READ (5,15) LL4,PL4
      PCUR(LL4)=PL4
      WRITE (6,31)
      READ (5,19) Q8
      IF (Q8.EQ.1.) GO TO 108
  107 WRITE (6,32)
      READ (5,15) L5,P5
      PCAPI(L5)=P5
      WRITE (6,33)
      READ (5,19) Q9
      IF (Q9.EQ.1.) GO TO 109
  110 WRITE (6,34)
      READ (5,15) LE5,PE5
      PCAPT(LE5)=PE5
      WRITE (6,35)
      READ (5,19) Q10
      IF (Q10.EQ.1.) GO TO 110
  109 WRITE (6,36)
      READ (5,19) Q11
      IF (Q11.EQ.1.) GO TO 111
  112 WRITE (6,37)
      READ (5,15) LL5,PL5
      PCAPT(LL5)=PL5
      WRITE (6,38)
      READ (5,19) Q12
      IF (Q12.EQ.1.) GO TO 112
  111 WRITE (6,39)
      READ (5,40) NT1
      WRITE (6,41)
      READ (5,40) NT2
      WRITE (6,42)
      READ (5,40) NT3
      WRITE (6,43)
      READ (5,40) NT4
      WRITE (6,44)
      READ (5,40) NT5
      WRITE (6,45)
      READ (5,40) NT6
      WRITE (6,74)
      WRITE (6,75)
      READ (5,19) Q13
      IF (Q13.EQ.1.) GO TO 121
  122 WRITE (6,60)
```

```
      READ (5,60) KG1
      KYG1=KG1-KSTART
      WRITE (6,67)
      READ (5,48) F1
      S2(KYG1)=F1*TENS(KYG1)
      WRITE (6,68)
      READ (5,19) Q14
      IF (Q14.EQ.1.) GO TO 122
  121 WRITE (6,65)
      READ (5,19) Q15
      IF (Q15.EQ.1.) GO TO 123
  124 WRITE (6,66)
      READ (5,60) KG2
      KYG2=KG2-KSTART
      WRITE (6,67)
      READ (5,48) F2
      S3(KYG2)=F2*TLTJG(KYG2)
      WRITE (6,70)
      READ (5,19) Q16
      IF (Q16.EQ.1.) GO TO 124
  123 WRITE (6,71)
      READ (5,19) Q17
      IF (Q17.EQ.1.) GO TO 113
  114 WRITE (6,66)
      READ (5,60) KG3
      KYG3=KG3-KSTART
      WRITE (6,67)
      READ (5,48) F3
      S4(KYG3)=F3*TLT(KYG3)
      WRITE (6,72)
      READ (5,19) Q18
      IF (Q18.EQ.1.) GO TO 114.
  113 WRITE (6,73)
      READ (5,19) Q19
      IF (Q19.EQ.1.) GO TO 115
  116 WRITE (6,65)
      READ (5,60) KG4
      KYG4=KG4-KSTART
      WRITE (6,67)
      READ (5,48) F4
      S5(KYG4)=F4*TLODR(KYG4)
      WRITE (6,74)
      READ (5,19) Q20
      IF (Q20.EQ.1.) GO TO 116
  115 WRITE (6,75)
      READ (5,19) Q21
      IF (Q21.EQ.1.) GO TO 117
  118 WRITE (6,76)
```

```
      READ (5,66) KG5
      KYG5=KG5-KSTART
      WRITE (6,67)
      READ (5,48) F5
      SO(KYG5)=F5*TCOR(KYG5)
      WRITE (6,76)
      READ (5,19) Q22
      IF (Q22.EQ.1.) GO TO 118
  117 CONTINUE
      WRITE (6,46)
      WRITE (6,47)
      READ (5,48) A
      WRITE (6,49)
      READ (5,40) LOS
      WRITE (6,50)
      READ (5,48) B
      WRITE (6,51)
      READ (5,48) C3
      WRITE (6,52)
      READ (5,48) C4
      WRITE (6,62)
      READ (5,48) C5
      WRITE (6,53)
      READ (5,48) R1
      WRITE (6,54)
      READ (5,48) R2
      WRITE (6,55)
      READ (5,48) R3
      WRITE (6,56)
      READ (5,19) L7,F
```

********** ******** LOSS COMPUTATION SECTION **********

```
      DO 6 K=1,30
      RLOS1(K)=A
      RLOS2(K)=A
      RLOS3(K)=A
      RLOS4(K)=A
      RLOS5(K)=A
      RLOS6(K)=A
      IF (K.GT.LOS) RLOS3(K)=A+C3
      IF (K.GT.LOS) RLOS4(K)=A+C4
      IF (K.GE.LOS) RLOS5(K)=A+C5
      IF (K.GE.2  ) RLOS4(K)=A+R1
      IF (K.GE.2  ) RLOS5(K)=A+R2
      IF (K.GE.2  ) RLOS6(K)=A+R3
```

```
    6 CONTINUE
      RLOS1(LOS)=A+B
      RLOS2(LOS)=A+B
      RLOS3(LOS)=A+B
      RLOS6(L7)=A+B+F

**********  MANPOWER COMPUTATION SECTION  **********

      DO 1 I=31,KH
      IF (I.GT.31) GO TO 125
      DO 120 J=1,36
      TLTJG(J)=TLTJG(J)+S2(J)
      TENS(J)=TENS(J)-S2(J)
      TLT(J)=TLT(J)+S3(J)
      TLTJG(J)=TLTJG(J)-S3(J)
      TLCDR(J)=TLCDR(J)+S4(J)
      TLT(J)=TLT(J)-S4(J)
      TCDR(J)=TCDR(J)+S5(J)
      TLCDR(J)=TLCDR(J)-S5(J)
      TCAPT(J)=TCAPT(J)+S6(J)
      TCDR(J)=TCDR(J)-S6(J)
  120 CONTINUE
  125 CONTINUE
      DO 1 K=1,KH
      IF (I.LE.K) GO TO 1
      IF (I-K.GT.36) GO TO 1
      TLTJG(K)=TLTJG(K)+PLTJG(I-K)*TENS(K)
      TENS(K)=(1.-PLTJG(I-K))*TENS(K)
      IF (I-K.GT.ATL) TENS(K)=0.
      TLT(K)=TLT(K)+PLT(I-K)*TLTJG(K)
      TLTJG(K)=(1.-PLT(I-K))*TLTJG(K)
      IF (I-K.GT.F2) TLTJG(K)=0.
      TLCDR(K)=TLCDR(K)+PLCDR(I-K)*TLT(K)
      TLT(K)=(1.-PLCDR(I-K))*TLT(K)
      IF (I-K.GT.M13) TLT(K)=0.
      TCDR(K)=TCDR(K)+PCDR(I-K)*TLCDR(K)
      TLCDR(K)=(1.-PCDR(I-K))*TLCDR(K)
      IF (I-K.GT.A14) TLCDR(K)=0.
      TCAPT(K)=TCAPT(K)+PCAPT(I-K)*TCDR(K)
      TCDR(K)=(1.-PCAPT(I-K))*TCDR(K)
      IF (I-K.GT.15) TCDR(K)=0.
      IF (I-K.GT.17) TCAPT(K)=0.
      TENS(K)=(1.-PLOS1(I-K))*TENS(K)
      TLTJG(K)=(1.-PLOS2(I-K))*TLTJG(K)
      TLT(K)=(1.-PLOS3(I-K))*TLT(K)
      TLCDR(K)=(1.-PLOS4(I-K))*TLCDR(K)
```

```
      TCDR(K)=(1.-RLOS5(I-K))*TCDR(K)
      TCAPT(K)=(1.-RLOS6(I-K))*TCAPT(K)
    1 CONTINUE

*********************************  OUTPUT SECTION  ********************************

      SENS=0.
      SLTJG=0.
      SLT=0.
      SLCDR=0.
      SCDR=0.
      SCAPT=0.
      DO 2 K=1,KH
      SENS=SENS+TENS(K)
      SLTJG=SLTJG+TLTJG(K)
      SLT=SLT+TLT(K)
      SLCDR=SLCDR+TLCDR(K)
      SCDR=SCDR+TCDR(K)
      SCAPT=SCAPT+TCAPT(K)
    2 CONTINUE
      WRITE (6,3.  ) KHZN
      KH1=KH-29
      DO 4 K=KH1,KH
      KK=K+KSTART
      WRITE (6,3   ) KK,TENS(K),TLTJG(K),TLT(K),TLCDR(K),TCDR(K),TCAPT(K)
    4 CONTINUE
      WRITE (6,3.2) SENS,SLTJG,SLT,SLCDR,SCDR,SCAPT
      STOP
      END
```

```
**********  TIME IN GRADE MANPOWER PLANNING MODEL  **********
**********  FRANK WILLIAM REISNYDER, JR.  **********

**********  FORMAT SECTION  **********

      DIMENSION R1(31,15),R2(31,15),R3(31,15),R4(31,15),R5(31,15),R6(31,
     115),P2(15),P3(15),P4(15),P6(15),P5(15),PLOS1(15),PLOS2(15),PLOS3(1
     25),PLOS4(15),PLOS5(15),PLOS6(15),TR1(31),TR2(31),TR3(31),TR4(31),T
     3R5(31),TR6(31),S2(15),S3(15),S4(15),S5(15),S6(15)
  100 FORMAT (15F5.0)
  101 FORMAT (1X,'DO YOU DESIRE TO SEE THE CURRENT STATE OF THE SYSTEM?
     1YES=1. NO=0.')
  102 FORMAT (F3.1)
  103 FORMAT ('1',42X,'OFFICER STRUCTURE',1X,I4,/,1X,'RANK',46X,'TIME IN
     1 GRADE',/,12X,'1',5X,'2',5X,'3',5X,'4',5X,'5',5X,'6',5X,'7'
     2,5X,'8',5X,'9',4X,'10',4X,'11',4X,'12',4X,'13',4X,'14',4X,'15',2X,
     3'TOTAL')
  104 FORMAT (1X,'ENS',5X,F5.0,1X,F5.0,1X,F5.0,1X,F5.0,1X,F5.0,1X,F5.0,1
     1X,F5.0,1X,F5.0,1X,F5.0,1X,F5.0,1X,F5.0,1X,F5.0,1X,F5.0,1X,F5.0,1X,
     2F5.0,1X,F6.0)
  105 FORMAT (6X,'BY ANSWERING THE FOLLOWING QUESTIONS THE OFFICER STRUC
     1TURE WILL BE PREDICTED',/,1X,'FOR ',I4,'.  ALL TIMES REFER TO TIME
     2 IN GRADE (2 DIGITS) UNLESS OTHERWISE SPECIFIED.',/,1X,'WHEN AND W
     3HAT FRACTION QUESTIONS ARE ANSWERED BY TYPING THE TIME IN GRADE (2
     4 DIGITS),',/,1X,'LEAVING 1 SPACE BLANK, AND THEN TYPING THE DECIMA
     5L FRACTION.  EX.  12 .25',/,/,/,1X,'WE ARE NOW READY TO BEGIN.')
  106 FORMAT (1X,'HOW MANY NEW ENS ARE COMMISSIONED EACH YEAR?')
  107 FORMAT (F5.0)
  108 FORMAT ('1',1X,'TYPE THE YEAR YOU DESIRE TO PREDICT. EX. 1985',/)
  109 FORMAT (1X,'WHEN AND WHAT FRACTION OF ENS ARE PROMOTED TO LTJG?')
  110 FORMAT (1X,'WHEN AND WHAT FRACTION OF LTJG ARE PROMOTED TO LT?')
  111 FORMAT (1X,'WHEN IS THE FIRST PROMOTION TO LCDR AND WHAT FRACTION
     1ARE PROMOTED?')
  112 FORMAT (1X,'ANY OTHER PROMOTIONS TO LCDR? YES=1. NO=0.')
  113 FORMAT (1X,'WHEN IS THE NEXT PROMOTION TO LCDR AND WHAT FRACTION A
     1RE PROMOTED?')
  114 FORMAT (1X,'WHEN IS THE FIRST PROMOTION TO CDR AND WHAT FRACTION A
     1RE PROMOTED?')
  115 FORMAT (1X,'ANY OTHER PROMOTIONS TO CDR? YES=1. NO=0.')
  116 FORMAT (1X,'WHEN IS THE NEXT PROMOTION TO CDR AND WHAT FRACTION AR
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   1E PROMOTED?')
117 FORMAT (1X,'WHEN IS THE FIRST PROMOTION TO CAPT AND WHAT FRACTION
   1ARE PROMOTED?')
118 FORMAT (1X,'ANY OTHER PROMOTIONS TO CAPT? YES=1. NO=0.')
119 FORMAT (1X,'WHEN IS THE NEXT PROMOTION TO CAPT AND WHAT FRACTION A
   1RE PROMOTED?')
12- FORMAT (1X,'DO  CONSIDER LOSSES TO THE SYSTEM.')
121 FORMAT (1X,'WHAT RANK DOES OBLIGATED SERVICE EXPIRE IN? ENS=1. LTJ
   1G=2. LT=3.')
122 FORMAT (1X,'AFTER WHAT TIME IN THAT RANK DOES OBLIGATED SERVICE EX
   1PIRE?')
123 FORMAT (1X,'WHAT FRACTION LEAVE AT THE END OF OBLIGATED SERVICE?')
124 FORMAT (1X,'WHAT FRACTION DIE OR MEDICALLY RETIRE EACH YEAR?')
125 FORMAT (1X,'WHAT FRACTION OF LT RESIGN EACH YR AFTER OBLIGATED SER
   1VICE?')
126 FORMAT (1X,'WHAT FRACTION OF LCDR RESIGN EACH YR PRIOR TO RETIREME
   1NT?')
127 FORMAT(1X,'AFTER WHAT TIME IN GRADE ARE LCDR ELIGIBLE TO RETIRE?')
128 FORMAT (1X,'WHAT FRACTION OF THOSE LCDR ELIGIBLE RETIRE EACH YR?')
129 FORMAT (1X,'WHAT FRACTION OF CDR RESIGN EACH YR PRIOR TO RETIREMEN
   1T?')
13  FORMAT (1X,'AFTER WHAT TIME IN GRADE ARE CDR ELIGIBLE TO RETIRE?')
131 FORMAT (1X,'WHAT FRACTION OF THOSE CDR ELIGIBLE RETIRE EACH YR?')
132 FORMAT (1X,'WHAT FRACTION OF THOSE CAPT ELIGIBLE RETIRE EACH YR?')
133 FORMAT (1X,'WHEN AND WHAT FRACTION OF CAPT ARE PROMOTED TO FLAG?')
134 FORMAT (1X,'WHAT IS THE MAXIMUM TIME IN GRADE FOR ENS?')
135 FORMAT (1X,'FOR LTJG?')
136 FORMAT (1X,'FOR LT?')
137 FORMAT (1X,'FOR LCDR?')
138 FORMAT (1X,'FOR CDR?')
139 FORMAT (1X,'FOR CAPT?')
14  FORMAT (I4)
141 FORMAT (I2,1X,F5.3)
142 FORMAT (I2)
143 FORMAT (F5. )
144 FORMAT (1X,'LTJG',4X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,
   11X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X
   2,F5. ,1X,F5. )
145 FORMAT (1X,'LT',6X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X
   1,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F
   25. ,1X,F6. )
146 FORMAT (1X,'LCDR',4X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,
   11X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X
   2,F5. ,1X,F5. )
147 FORMAT (1X,'CDR',5X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1
   1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,
   2F5. ,1X,F6. )
148 FORMAT (1X,'CAPT',4X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,1X,F5. ,
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```
     11X,F5.4,1X,F5.4,1X,F5.4,1X,F5.4,1X,F5.4,1X,F5.4,1X,F5.4,1X
     2,F5.4,1X,F5.4,)
  149 FORMAT ('1',1X,'**********  TIME IN GRADE MANPOWER PLANNING MODE
     1L  **********',/)
  150 FORMAT (6X,'WHEN A CHANGE IN PROMOTION POLICY OCCURS SO THAT THE T
     1IME IN GRADE FOR ANY',/,1X,'PROMOTION IS DECREASED, THE POSSIBILIT
     2Y EXISTS THAT SOME GROUP OF OFFICERS WILL',/,1X,'MISS THEIR PRIMAR
     3Y CHANCE FOR PROMOTION.  TO CORRECT FOR THIS ERROR, THIS PROGRAM',
     4/,1X,'ALLOWS A FRACTION OF THAT GROUP TO BE SPOT PROMOTED TO THE
     5NEXT HIGHEST RANK.')
  151 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY GROUP OF ENS? YES=1.
     1 NO=0.')
  152 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY OTHER GROUP OF ENS?
     1YES=1.  NO=0.')
  153 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY GROUP OF LTJG? YES=1
     1 NO=0.')
  154 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY OTHER GROUP OF LTJG?
     1 YES=1.  NO=0.')
  155 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY GROUP OF LT? YES=1.
     1NO=0.')
  156 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY OTHER GROUP OF LT?
     1YES=1.  NO=0.')
  157 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY GROUP OF LCDR? YES=1
     1.  NO=0.')
  158 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY OTHER GROUP OF LCDR?
     1 YES=1.  NO=0.')
  159 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY GROUP OF CDR? YES=1.
     1 NO=0.')
  160 FORMAT (1X,'DO YOU DESIRE TO SPOT PROMOTE ANY OTHER GROUP OF CDR?
     1YES=1.  NO=0.')
  161 FORMAT (1X,'TYPE THE TIME IN GRADE (2 DIGITS) OF THE GROUP TO BE S
     1POT PROMOTED.')
  162 FORMAT (1X,'WHAT FRACTION DO YOU DESIRE TO SPOT PROMOTE?')

C**********  EXTERNAL INPUT SECTION  **********

      READ (4,100) (R1(1,I),I=1,15)
      READ (4,100) (R2(1,I),I=1,15)
      READ (4,100) (R3(1,I),I=1,15)
      READ (4,100) (R4(1,I),I=1,15)
      READ (4,100) (R5(1,I),I=1,15)
      READ (4,100) (R6(1,I),I=1,15)

C**********  MAN/MACHINE INTERFACE SECTION  **********
```

```
      WRITE (6,149)
      WRITE (6,101)
      READ (5,102) Q1
      IF (Q1.EQ.  .) GO TO 8
      KT=1971
      KSTART=KT-1
      WRITE (6,103) KT
      TR1(1)=0.
      TR2(1)=0.
      TR3(1)=0.
      TR4(1)=0.
      TR5(1)=0.
      TR6(1)=0.
      DO 24 I=1,15
      TR1(1)= TR1(1)+R1(1,I)
      TR2(1)=TR2(1)+R2(1,I)
      TR3(1)=TR3(1)+R3(1,I)
      TR4(1)=TR4(1)+R4(1,I)
      TR5(1)= TR5(1)+R5(1,I)
      TR6(1)=TR6(1)+R6(1,I)
   24 CONTINUE
      WRITE (6,104) (R1(1,I),I=1,15),TR1(1)
      WRITE (6,144) (R2(1,I),I=1,15),TR2(1)
      WRITE (6,145) (R3(1,I),I=1,15),TR3(1)
      WRITE (6,146) (R4(1,I),I=1,15),TR4(1)
      WRITE (6,147) (R5(1,I),I=1,15),TR5(1)
      WRITE (6,148) (R6(1,I),I=1,15),TR6(1)
    8 WRITE (6,110)
      READ (5,14 ) NP
      NT=NP-KSTART
      WRITE (6,1 9) NP
      WRITE (6,1 6)
      READ (5,1 7) ENS
      DO 9 K=2,NT
      R1(K,1)=ENS
      DO 1  I=2,15
      R1(K,I)=
   10 CONTINUE
      DO 9  I=1,15
      R2(K,I)=0.
      R3(K,I)=
      R4(K,I)=0.
      R5(K,I)=
      R6(K,I)=
    9 CONTINUE
      DO 11 I=1,15
      R2(I)=
```

```
      P3(I)=0.
      P4(I)=0.
      P5(I)=0.
      P6(I)=0.
   11 CONTINUE
      DO 34 J=1,15
      S2(J)=0.
      S3(J)=0.
      S4(J)=0.
      S5(J)=0.
      S6(J)=0.
   34 CONTINUE
      WRITE (6,109)
      READ (5,141) K2,PLTJG
      P2(K2)=PLTJG
      WRITE (6,110)
      READ (5,141) K3,PLT
      P3(K3)=PLT
      WRITE (6,111)
   13 READ (5,141) K4,PLCDR
      P4(K4)=PLCDR
      WRITE (6,112)
      READ (5,102) Q2
      IF (Q2.EQ.0.) GO TO 12
      WRITE (6,113)
      GO TO 13
   12 WRITE (6,114)
   15 READ (5,141) K5, PCDR
      P5(K5)=PCDR
      WRITE (6,115)
      READ (5,102)Q3
      IF (Q3.EQ. .) GO TO 14
      WRITE (6,116)
      GO TO 15
   14 WRITE (6,117)
   17 READ (5,141) K6,PCAPT
      P6(K6)=PCAPT
      WRITE (6,118)
      READ (5,102) Q4
      IF (Q4.EQ.0.) GO TO 16
      WRITE (6,119)
      GO TO 17
   16 CONTINUE
      WRITE (6,[illegible])
      WRITE (6,151)
      READ (5,147) Q5
      IF (Q5.E .0.) GO TO 35
   35 WRITE (6,151)
```

```
      READ (5,142) J1
      WRITE (6,162)
      READ (5,143) F1
      S2(J1)=F1*P1(1,J1)
      WRITE (6,152)
      READ (5,143) Q6
      IF (Q6.EQ.1.) GO TO 36
   35 WRITE (6,153)
      READ (5,143) Q7
      IF (Q7.EQ.1.) GO TO 37
   38 WRITE (6,161)
      READ (5,142) J2
      WRITE (6,162)
      READ (5,143) F2
      S3(J2)=F2*P2(1,J2)
      WRITE (6,154)
      READ (5,143) Q8
      IF (Q8.EQ.1.) GO TO 38
   37 WRITE (6,155)
      READ (5,143) Q9
      IF (Q9.EQ.1.) GO TO 39
   40 WRITE (6,161)
      READ (5,142) J3
      WRITE (6,162)
      READ (5,143) F3
      S4(J3)=F3*P3(1,J3)
      WRITE (6,156)
      READ (5,143) Q10
      IF (Q10.EQ.1.) GO TO 4
   39 WRITE (6,157)
      READ (5,143) Q11
      IF (Q11.EQ.1.) GO TO 41
   42 WRITE (6,161)
      READ (5,142) J4
      WRITE (6,162)
      READ (5,143) F4
      S5(J4)=F4*P4(1,J4)
      WRITE (6,158)
      READ (5,143) Q12
      IF (Q12.EQ.1.) GO TO 42
   41 WRITE (6,159)
      READ (5,143) Q13
      IF (Q13.EQ.1.) GO TO 43
   44 WRITE (6,161)
      READ (5,142) J5
      WRITE (6,162)
      READ (5,143) F5
      S6(J5)=F5*P5(1,J5)
```

```
      WRITE (6,16 )
      READ (5,143) Q14
      IF (Q14.EQ.1.) GO TO 44
   43 CONTINUE
      WRITE (6,120)
      WRITE (6,121)
      READ (5,102) ROS
      WRITE (6,122)
      READ (5,142) LOS
      WRITE (6,123)
      READ (5,143) B
      WRITE (6,124)
      READ (5,143) A
      WRITE (6,125)
      READ (5,143) C1
      WRITE (6,126)
      READ (5,143) C2
      WRITE (6,127)
      READ (5,142) KF1
      WRITE (6,128)
      READ (5,143) D1
      WRITE (6,129)
      READ (5,143) C3
      WRITE (6,130)
      READ (5,142) KF2
      WRITE (6,131)
      READ (5,143) D2
      WRITE (6,132)
      READ (5,143) D3
      WRITE (6,133)
      READ (5,141) KF, FLAG
      WRITE (6,134)
      READ (5,142) NT1
      WRITE (6,135)
      READ (5,142) NT2
      WRITE (6,136)
      READ (5,142) NT3
      WRITE (6,137)
      READ (5,142) NT4
      WRITE (6,138)
      READ (5,142) NT5
      WRITE (6,139)
      READ (5,142) NT6
```

********** LOSS COMPUTATION SECTION **********

```
      DO 32 I=1,15
      RLOS1(I)=0.
      RLOS2(I)=0.
      RLOS3(I)=0.
      RLOS4(I)=0.
      RLOS5(I)=0.
      RLOS6(I)=0.
   32 CONTINUE
      DO 18 I=1,NT1
        RLOS1(I)=A
   18 CONTINUE
      IF (ROS.EQ.1.) RLOS1(LOS)=A+B
      DO 19 I=1,NT2
      RLOS2(I)=A
   19 CONTINUE
      IF (ROS.EQ.2) RLOS2(LOS)=A+B
      DO 20 I=1,NT3
      RLOS3(I)=A
      IF (ROS.LT.3.0) GO TO 20
      IF (I.GT.LOS) RLOS3(I)=A+C1
   20 CONTINUE
      IF (ROS.EQ.3.) RLOS3(LOS)=A+B
      DO 21 I=1,NT4
      IF (I.LT.KR1) RLOS4(I)=A+C2
      IF (I.GE.KR1) RLOS4(I)=A+D1
   21 CONTINUE
      DO 22 I=1,NT5
      IF (I.LT.KR2) RLOS5(I)=A+C3
      IF (I.GE.KR2) RLOS5(I)=A+D2
   22 CONTINUE
      DO 23 I=1,NT6
      RLOS6(I)=A+D3
   23 CONTINUE
      RLOS6(KF)=A+D3+FLAG
      DO 31 I=1,15
      IF (RLOS1(I).GT.1.0) RLOS1(I)=1.0
      IF (RLOS2(I).GT.1.0) RLOS2(I)=1.0
      IF (RLOS3(I).GT.1.0) RLOS3(I)=1.0
      IF (RLOS4(I).GT.1.0) RLOS4(I)=1.0
      IF (RLOS5(I).GT.1.0) RLOS5(I)=1.0
      IF (RLOS6(I).GT.1.0) RLOS6(I)=1.0
   31 CONTINUE

********** MANPOWER COMPUTATION SECTION **********

      DO 23 J=1,15
```

```
      R2(1,1)=R2(1,1)+S2(J)
      R1(1,J)=R1(1,J)-S2(J)
      R3(1,1)=R3(1,1)+S3(J)
      R2(1,J)=R2(1,J)-S3(J)
      R4(1,1)=R4(1,1)+S4(J)
      R3(1,J)=R3(1,J)-S4(J)
      R5(1,1)=R5(1,1)+S5(J)
      R4(1,J)=R4(1,J)-S5(J)
      R6(1,1)=R6(1,1)+S6(J)
      R5(1,J)=R5(1,J)-S6(J)
   33 CONTINUE
      DO 3  K=2,NT
      KK=K-1
      DO 1  I=2,NT1
      II=I-1
      R2(K,I)=R2(K,I)+P2(I)*R1(KK,I)
      R1(K,I)=(1-P2(II))* R1(KK,II)
    1 CONTINUE
      R2(K,1)=R2(K,1)+P2(1)*R1(KK,1)
      DO 2  I=2,NT2
      II=I-1
      R3(K,I)= R3(K,I)+P3(I)* R2(KK,I)
      R2(K,I)=(1-P3(II))* R2(KK,II)
    2 CONTINUE
      R3(K,1)=R3(K,1)+P3(1)*R2(KK,1)
      DO 3  I=2,NT3
      II=I-1
      R4(K,I)=R4(K,I)+P4(I)*R3(KK,I)
      R3(K,I)=(1-P4(II))* R3(KK,II)
    3 CONTINUE
      R4(K,1)=R4(K,1)+P4(1)*R3(KK,1)
      DO 4  I=2,NT4
      II=I-1
      R5(K,I)= R5(K,I)+P5(I)* R4(KK,I)
      R4(K,I)=(1-P5(II))* R4(KK,II)
    4 CONTINUE
      R5(K,1)=R5(K,1)+P5(1)*R4(KK,1)
      DO 5  I=2,NT5
      II=I-1
      R6(K,I)=R6(K,I)+P6(I)*R5(KK,I)
      R5(K,I)=(1-P6(II))* R5(KK,II)
    5 CONTINUE
      R6(K,1)=R6(K,1)+P6(1)*R5(KK,1)
      DO 6  I=2,NT6
      II=I-1
      R6(K,I)=R6(KK,II)
    6 CONTINUE
      DO 7  I=1,NT1
```

```
      R1(K,I)=(1-PLOS1(I))* R1(K,I)
    7 CONTINUE
      DO 26 I=1,NT2
      R2(K,I)=(1-PLOS2(I))* R2(K,I)
   26 CONTINUE
      DO 27 I=1,NT3
      R3(K,I)=(1-PLOS3(I))*R3(K,I)
   27 CONTINUE
      DO 28 I=1,NT4
      R4(K,I)=(1-PLOS4(I))* R4(K,I)
   28 CONTINUE
      DO 29 I=1,NT5
      R5(K,I)=(1-PLOS5(I))* R5(K,I)
   29 CONTINUE
      DO 30 I=1,NT6
      R6(K,I)=(1-PLOS 6(I))* R6(K,I)
   30 CONTINUE
```

********** OUTPUT SECTION **********

```
      WRITE (6,102) NP
      TR1(NT)=0.
      TR2(NT)=0.
      TR3(NT)=0.
      TR4(NT)=0.
      TR5(NT)=0.
      TR6(NT)=0.
      DO 25 I=1,15
      TR1(NT)=TR1(NT)+R1(NT,I)
      TR2(NT)=TR2(NT)+R2(NT,I)
      TR3(NT)=TR3(NT)+R3(NT,I)
      TR4(NT)=TR4(NT)+R4(NT,I)
      TR5(NT)=TR5(NT)+R5(NT,I)
      TR6(NT)=TR6(NT)+R6(NT,I)
   25 CONTINUE
      WRITE (6,104) (R1(NT,I),I=1,15),TR1(NT)
      WRITE (6,144) (R2(NT,I), I=1,15),TR2(NT)
      WRITE (6,145) (R3(NT,I), I=1,15),TR3(NT)
      WRITE (6,146) (R4(NT,I),I=1,15),TR4(NT)
      WRITE (6,147) (R5(NT,I),I=1,15),TR5(NT)
      WRITE (6,148) (R6(NT,I),I=1,15),TR6(NT)
      STOP
      END
```

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ABSTRACT

This thesis develops two personnel flow models which can aid the manpower olicy planner to predict future officer structures through the use of a time- hared computer system. The underlying structure is presented for both models. ne model considers promotions based on length of commissioned service. The ther model considers promotions based on length of time in grade. Computer rograms are developed for both models and sample outputs are shown. The rograms are used on a time-shared computer system so that the policy planner an interact with the computer with a minimal knowledge of computer programming. he computer output is in a concise, easy to understand form.

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